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SURGICAL OUTCOMES AND PROGNOSTIC FACTORS IN GASTROINTESTINAL STROMAL TUMORS: A HYBRID PROSPECTIVE–RETROSPECTIVE STUDY FROM A TERTIARY CARE CENTER IN WESTERN INDIA

Surgery

Dr Hasmukh B Vora Associate Professor, Department of Surgical Gastroenterology, SVP Hospital, Smt. NHL Municipal Medical College, Ahmedabad Gujarat 380006.

Dr Ravi M Sudani Third year MCh Resident, Department of Surgical Gastroenterology, SVP Hospital, Smt. NHL Municipal Medical College, Ahmedabad Gujarat 380006.

ABSTRACT

Background: Gastrointestinal stromal tumors (GISTs) are the most common mesenchymal tumors of the gastrointestinal tract. Despite advances in molecular biology and targeted therapy, surgical resection remains the cornerstone of curative treatment. **Aim:** To evaluate surgical outcomes and identify clinicopathological prognostic factors influencing recurrence and survival.**Methods:** Hybrid prospective–retrospective study (January 2021–December 2025). Forty-six patients undergoing curative resection were analyzed. Kaplan–Meier survival analysis performed. **Results:** Mean age 52.5 ± 12.5 years. Stomach most common site (45%). High mitotic index significantly associated with recurrence (p=0.001). Mean RFS 39.8 months; median OS 47.9 months. **Conclusion:** Tumor size, mitotic index, and risk group significantly influence recurrence. Surgical resection with risk-adapted imatinib yields outcomes comparable to international data.

KEYWORDS

GIST; Gastrointestinal stromal tumor; Surgical outcomes; Mitotic rate; Recurrence-free survival; Imatinib; Indian cohort

INTRODUCTION

Gastrointestinal stromal tumors (GISTs) are rare neoplasms but constitute the most common mesenchymal tumors of the gastrointestinal tract. They most frequently arise in the stomach (56%) and small intestine (32%), followed by the colon, rectum, and esophagus (<1%), with about 5% occurring in extra-gastrointestinal sites such as the mesentery and omentum [1]. Historically classified as smooth muscle tumors, GISTs were recognized as a distinct entity after improved pathological characterization in the 1980s [2].

The reported global incidence ranges from 4–22 cases per million annually, with most patients diagnosed after 50 years (median 63 years) [3]. Large-scale Indian data are lacking; however, smaller studies suggest a median age of 50–58 years and more frequent advanced-stage presentation [4]. Approximately 18–25% of cases are detected incidentally, while others present with bleeding, obstruction, or perforation [5].

GIST pathogenesis is primarily driven by KIT mutations (75–80%) or PDGFRA alterations, influencing treatment response. Molecular testing in India remains limited. Diagnosis is supported by CD117 and DOG1 immunopositivity [6]. Surgical resection is standard for localized disease [7], with adjuvant imatinib improving recurrence-free survival in high-risk cases [8].

MATERIALS AND METHODS

Study Design And Setting

This was a hybrid prospective–retrospective observational study conducted at SVP Hospital, Ahmedabad, India, between January 2021 and December 2025. The study was carried out in the Department of Surgical Gastroenterology, SVP Hospital, affiliated with Smt. NHL Municipal Medical College, Ahmedabad, India.

Study Population

Patients with histologically confirmed gastrointestinal stromal tumors (GISTs) who underwent curative surgical resection during the study period were included. Patients presenting with metastatic or inoperable disease and those with alternative histopathological diagnoses were excluded. A total of 46 patients fulfilled the eligibility criteria and were included in the final analysis.

Data Collection

Demographic, clinical, pathological, and treatment-related variables were recorded. These included age, gender, tumor site, pathological tumor size, T stage (AJCC 9th edition), mitotic index, histological subtype, and immunohistochemical markers (CD117, CD34, DOG1). Risk stratification was performed using the Modified NIH (Joensuu) criteria. Details regarding neoadjuvant therapy, surgical approach, postoperative complications, recurrence, and survival outcomes were also documented.

Statistical Analysis

Statistical analysis was performed using SPSS version 29. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Patient Cohort and Treatment Overview

During the study period from January 2021 to December 2025, a total of 46 patients were diagnosed with gastrointestinal stromal tumor (GIST) and underwent surgical intervention with curative intent. All patients were identified from institutional medical records and managed at our tertiary care center. The primary tumor sites ranged from stomach and small intestine to colon, rectum, pancreas, peritoneum, and retroperitoneum.

Ten patients (21.74%) received neoadjuvant imatinib therapy prior to surgery due to locally advanced disease at presentation. Two patients (4.35%) expired during the study period: one due to postoperative pancreatic fistula complicated by sepsis following pancreatoduodenectomy, and the other due to cardiopulmonary complications in the setting of metastatic progression. These two patients were excluded from survival analysis.

Demographic And Epidemiological Profile

Of the 46 patients, 25 (54.3%) were female and 21 (45.7%) were male. The overall mean age at presentation was 52.54 ± 12.52 years (range 27–81 years).

The highest incidence was observed in the 56–65-year age group. Pancreatic and retroperitoneal GISTs appeared to present at relatively earlier ages, whereas rectal GISTs presented later; however, small subgroup numbers precluded meaningful statistical inference.

Table 1: Baseline Characteristics

Total Patients	46
Females	25 (54.3%)
Males	21 (45.7%)
Mean Age	52.54 ± 12.52 years

Primary Site Distribution

The stomach was the most common primary site (n=21, 45%), followed by small bowel excluding duodenum (n=12, 26%). Other sites included duodenum (n=5), colon (n=4), rectum (n=2), pancreas (n=1), and retroperitoneum (n=1).

Table 2: Primary Site Distribution

Site	n (%)
Stomach	21 (45%)
Small bowel	12 (26%)
Duodenum	5
Colon	4
Rectum	2
Pancreas	1
Retroperitoneum	1

Among females, the stomach was the predominant site (52%), followed by small bowel (16%) and duodenum (16%). In males, both stomach (38.1%) and small bowel (38.1%) were equally common, followed by colon (9.52%). However, this gender-based site distribution did not reach statistical significance (p=0.128).

Tumor Stage And Risk Stratification

According to AJCC 9th edition staging, the majority of patients presented with advanced T stage disease. In males, 43% were T3 and 33% were T4. Similarly, in females, 44% were T3 and 28% were T4. Notably, no T1 tumors were observed in the cohort, suggesting delayed detection in the absence of screening practices.

Risk stratification using Modified NIH (Joensuu) criteria demonstrated no very-low-risk cases. Low-risk tumors comprised 21.74%, while moderate- and high-risk groups each accounted for 39.13% of cases.

Histopathology And Mitotic Index

Spindle cell morphology was the most common histological subtype (69.56%), followed by epithelioid (23.91%) and mixed type (6.52%). The stomach was the most frequent site for both spindle and epithelioid variants.

Most tumors (n=36, 78.26%) had a low mitotic index (≤5/50 HPF), whereas 10 patients (21.74%) had a high mitotic rate (>5/50 HPF). High mitotic rate was more frequently observed in small bowel GISTs. Immunohistochemically, CD117 and DOG1 positivity were observed in 91.3% of cases each, forming the diagnostic backbone. CD34 positivity was seen in 63.04% of patients. No triple-negative ("wild type") GISTs were identified.

Table 3: Histopathological Characteristics

Spindle cell	69.6%
Epithelioid	23.9%
Mixed	6.5%
Mitotic index ≤5/50 HPF	78.3%
Mitotic index >5/50 HPF	21.7%

Neoadjuvant Therapy

Ten patients received neoadjuvant imatinib for tumor downsizing. The mean pre-treatment tumor size was 9.20 ± 4.42 cm. Median duration of therapy was 8.5 months (range 1–16 months). Response assessment using Choi criteria demonstrated good response in 60%, partial/stable response in 20%, and progression in 20%.

Surgical Outcomes

All surgeries were performed with intent to achieve R0 resection. Eight patients (17.39%) required multivisceral resection, most commonly involving spleen and distal pancreas. Laparoscopic resection was performed in 16 patients (34.8%) without conversion. Mean tumor size in laparoscopic cases was 5.26 ± 1.72 cm compared to 9.65 ± 3.66 cm in open surgeries.

Thirty-day mortality was 2.17%. Postoperative complications included anastomotic leak, sepsis, surgical site infection, paralytic ileus, and respiratory complications. The mean hospital stay was 13.33 ± 7.55 days.

Adjuvant Therapy And Recurrence

Forty-five patients received adjuvant imatinib (median duration 24 months). Of 28 patients who completed therapy, 7 (25%) developed recurrence—five local and two hepatic metastases.

Among 45 evaluable patients, 12 developed recurrence. Tumor size (p=0.014), high mitotic rate (p=0.001), and high-risk group (p=0.047) were significantly associated with recurrence. Gender (p=0.66), site (p=0.685), and neoadjuvant therapy (p=0.219) were not statistically significant predictors.

Table 4: Significant Predictors Of Recurrence

Variable	p value
Tumor size	p=0.014
High mitotic rate	p=0.001
Risk group	p=0.047

Survival Outcomes

Mean follow-up was 24.47 ± 13.20 months. Mean recurrence-free survival (RFS) was 39.8 months (95% CI: 35.08–44.43), and median RFS was 48 months. Patients with low mitotic index had significantly superior RFS (mean 41.8 months) compared to those with high mitotic rate (mean 19.5 months; log-rank p<0.001). T stage did not show significant difference in RFS (p=0.166).

Median overall survival was 47.9 months. Tumor size, mitotic rate, and risk group significantly influenced overall survival outcomes.

DISCUSSION

Gastrointestinal stromal tumors (GISTs), arising from the interstitial cells of Cajal, are the most common mesenchymal tumors of the gastrointestinal tract. Since their characterization as a distinct entity risk stratification has evolved over time; however, no single universally accepted prognostic model exists.

In the present study, the median age at diagnosis was 53 years, nearly a decade younger than that reported in Western literature but consistent with Indian series. The stomach was the most frequent primary site, in agreement with global trends, although some Indian studies report small intestinal predominance. A slight female preponderance was observed. Histologically, spindle cell morphology predominated (69.5%). Most tumors demonstrated a low mitotic index (78.3%), and CD117 positivity was observed in over 90% of cases, comparable to established literature.

Risk stratification revealed equal proportions of intermediate- and high-risk tumors, reflecting delayed presentation. Upfront surgery was feasible in most patients, while neoadjuvant imatinib demonstrated response rates comparable to pivotal trials. Tumor size, mitotic index, and risk group significantly influenced recurrence and survival, reinforcing their prognostic relevance. Although outcomes were encouraging, the lack of routine mutational analysis remains a limitation and underscores the need for molecular-guided therapy in future practice.

CONCLUSION

The present study provides a comprehensive clinicopathological and outcome-based evaluation of gastrointestinal stromal tumors (GISTs) in our regional population. The median age of 53 years aligns with reports from the Indian subcontinent , though slightly younger than Western data. The stomach was the predominant primary site, and the distribution of histological subtypes, mitotic index, and immunohistochemical markers paralleled established literature. CD117 and CD34 positivity rates were consistent with previously reported findings (5), confirming the diagnostic reliability of immunohistochemistry in our setting.

Risk stratification using Modified NIH (Joensuu) criteria (13) demonstrated a predominance of intermediate- and high-risk tumors, likely reflecting referral bias and delayed presentation. Tumor size, T stage, mitotic rate, and composite risk group showed significant associations with survival outcomes, corroborating earlier studies (5,9). Therapeutic outcomes following adherence to NCCN-based management—including selective neoadjuvant therapy and universal risk-adapted adjuvant imatinib—were comparable to pivotal trials such as the B2222 study (10) and other Western reports.

Despite encouraging outcomes, limitations include small sample size and absence of routine mutational analysis. Future integration of molecular profiling and larger prospective studies are essential to refine prognostication and optimize individualized management strategies.

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